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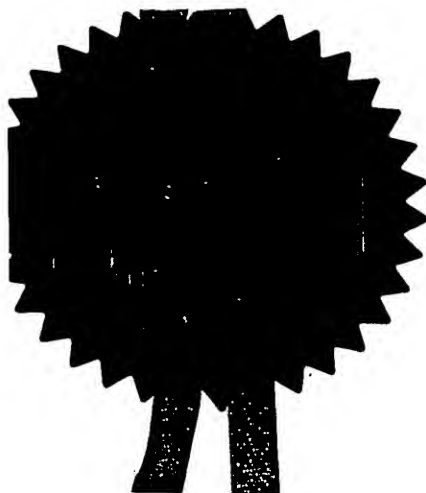
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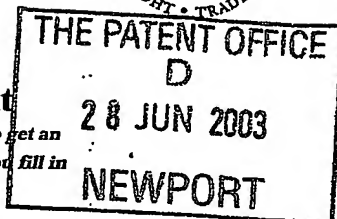
6 July 2004



30JUN03 E818756-3 000239
P01/7700-0:00-0315178.4

Request for grant of a patent

(See the notes on the back of this form. You can also get an explanatory leaflet from the Patent Office to help you fill in this form)



The Patent Office

Cardiff Road
Newport
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NP10 8QQ

1. Your reference CNIP12812GB

2. Patent application number
(The Patent Office will fill in this part)

0315178.4

28 JUN 2003

3. Full name, address and postcode of the or of each applicant (underline all surnames)

Ardmel Automation Limited
274 Sauchiehall Street
Glasgow
G2 3EH

Patents ADP number (if you know it)

If the applicant is a corporate body, give the country/state of its incorporation

United Kingdom

8071276002

4. Title of the invention

Seaming Apparatus

5. Name of your agent (if you have one)

Cruikshank & Fairweather

"Address for service" in the United Kingdom to which all correspondence should be sent (including the postcode)

19 Royal Exchange Square
Glasgow, G1 3AE
Scotland, UK

Patents ADP number (if you know it)

547002

6. If you are declaring priority from one or more earlier patent applications, give the country and the date of filing of the or of each of these earlier applications and (if you know it) the or each application number

Country

Priority application number
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Date of filing
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7. If this application is divided or otherwise derived from an earlier UK application, give the number and the filing date of the earlier application

Number of earlier application

Date of filing
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8. Is a statement of inventorship and of right to grant of a patent required in support of this request? (Answer 'Yes' if:

Yes

- a) any applicant named in part 3 is not an inventor, or
 - b) there is an inventor who is not named as an applicant, or
 - c) any named applicant is a corporate body.
- See note (d))

Patents Form 1/77

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Description 10

Claim(s) -

Abstract -

Drawing(s) 14

10. If you are also filing any of the following, state how many against each item.

Priority documents -

Translations of priority documents -

Statement of inventorship and right to grant of a patent (Patents Form 7/77) -

Request for preliminary examination and search (Patents Form 9/77) -

Request for substantive examination (Patents Form 10/77) -

Any other documents (please specify) -

11.

I/We request the grant of a patent on the basis of this application.

Signature

Campbell Newell
For Newell

Date

27/06/2003

12. Name and daytime telephone number of person to contact in the United Kingdom

Mr Campbell Newell - 0131 225 4500

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-1-
Seaming Apparatus

The present invention relates to a seaming apparatus, in particular an ultrasonic or laser seaming apparatus for use in joining together two or more fabric or material components without thread. The apparatus is particularly suitable for seaming garments for example protective or weatherproof and other garments such as underwear, sportswear and the like comprising materials including thermoplastic sheets or textile materials made of or including substantially thermoplastic fibres, but not exclusively.

Seaming apparatus of this type are known also as ultrasonic sewing machines though, for the avoidance of doubt, no needle and thread are used for providing a seam. Ultrasonic sewing machines are generally well known and comprise an ultrasonic horn operable to emit ultrasonic energy through a fabric/material engaging end face and a rotatable anvil support. The anvil support and the horn are arranged so as to define a "nip" between the respective fabric engaging surfaces thereof for receiving the fabric sheet materials (or components e.g. zipper fasteners) to be joined. Such apparatus is generally well known in the art and is described variously in for example, US 3852144; WO 02/49831A1; US 3785910; US 3666599; and others.

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In such known apparatus fabric material is fed through the apparatus utilising the rotary motion of the aforesaid anvil (or feed) wheel but such arrangements have two fundamental disadvantages. Firstly it has been found that the bearings in
5 such anvil wheels, being in close proximity to a very high frequency (ultrasonic) source are liable to rapid degradation and wear (including also complete bearing failure) which can result in considerable machine downtime and loss of productivity. The second particular problem associated with
10 known apparatus is that the material to be joined is "nipped" between the anvil/anvil wheel and the resonating horn more or less substantially continuously and it will be understood that where material to be joined is being fed through such apparatus, and being "nipped" thereby, it is difficult for an
15 operator to guide material through such a machine in such a way that significant changes in direction of the material, as it is passed through the apparatus, or for intricate seams can be realised. Yet a further disadvantage of known systems is that the movement of the material through known apparatus can
20 result in the material puckering resulting in seams which are uneven and/or not adequately weatherproofed, or at worst are unsightly and require the garment to be rejected as sub standard.

25 It is an objection of the present invention to avoid or minimise one or more of the foregoing disadvantages.

The present invention provides a seaming apparatus for joining, along a seam without thread, at least two superposed flexible sheet materials, said seaming apparatus comprising

5 bonding means for bonding together at least two flexible sheet materials, said bonding means having a nip portion for releasably engaging together sheet material in use of the apparatus; and drive means formed and arranged for engaging sheet material, in use and to be bonded, and moving

10 incrementally sheet material through said bonding means, said drive means being formed and arranged to co-operate with said nip portion so as to sequentially nip then drive material through the apparatus such that only one of said nip portion and said drive means is in contact with sheet material, in use

15 of the apparatus, at any given moment.

Thus with a seaming apparatus according to the present invention it is possible to feed sheet material to be seamed together through a machine and by virtue of the discontinuous

20 nature of the drive means engaging the sheet material it is possible, for the first time, to achieve sharp angle changes in direction in a seam and/or to form intricate seam patterns.

Preferably said bonding means comprises an ultrasonic horn (or

25 anvil) structure and a welding foot, said horn (or anvil) and said welding foot comprising said nip portion. Alternatively

there may be used a laser for bonding together said at least two superposed flexible sheet materials. Desirably where there is used a laser to bond together the material a layer of dye or radiation absorbing material may be deposited onto the material so as to focus the laser energy (or indeed ultrasonic energy) to where the bonding is required.

An example of a process for laser welding using a radiation absorbing material is the patented process of The Welding Institute, Cambridge disclosed in International Patent Publication No. WO 00/20157 known as the CLEARWELD (Registered Trade Mark) technique.

Preferably there is provided a pin portion (desirably on the horn portion) formed and arranged to pinch the sheet material and thereby to enable a material (garment) to be pivoted round for easy manoeuvring of the seam shape.

Preferably said bonding means is formed and arranged to provide a single discrete point of contact (bond) between said at least two superposed flexible sheet materials. In practice, and desirably, there may be provided a multiplicity of discrete points of contact between sheet materials where the thermoplastic constituents of such materials have fused and joined together. Advantageously said multiplicity of discrete joins or points of contact between flexible sheet

materials provides a substantially continuous and weatherproof seam for an article or garment manufactured using said seaming apparatus. Alternatively the seam produced by said seaming apparatus can be considered to be a plurality of overlapping discrete welds or fusion points which have the appearance of a continuous seam.

Any suitable form of drive means may be used, which drive means releasably engages sheet material in use of the apparatus and for driving sheet material through said bonding means. The drive means may comprise a feed gear or gears or at least one feed dog formed and arranged to cooperate with two corresponding moving feet, between which flexible sheet material is engaged. Said feed dog is formed and arranged to incrementally move sheet material through the bonding means, then disengage the sheet material, return in an opposite direction to that in which it was engaging the sheet material and then re-engage a next portion of sheet material. Such a feed dog arrangement may be driven by a cam arrangement to produce the required cycle of motion. Stepper motors or the like may be used to drive said feed dog or said cam arrangement driving said feed dog.

Preferably said drive means is adjustable so as to vary the feed rate of the material through the seaming apparatus. Desirably the rate at which said nip portion of said bonding

means "nips" is adjustable to correspond with any adjustments in the feed rate of the drive means, that is they are synchronised with one another. Desirably there is provided a controller means for co-ordinating operation of the drive means and the nip portion of the bonding means.

The points of contact of the nip portion can be designed to impart various patterned appearances to the fabric, materials or components being joined.

10

Further preferred features and advantages of the present invention will appear in the following detailed description given by way of an example of a preferred embodiment illustrated with reference to the accompanying drawings being which: -

15

Figures 1a to d and Figs. 2 and 3 show schematically the mode of operation of a seaming apparatus according to the present invention.

20

A seaming apparatus, generally located by reference 10, is shown schematically in Figures 1a to d. The apparatus is for joining, along a seam without a thread, two sheets 12, 14 of fabric material containing thermoplastic fibres. The apparatus 10 comprises two essential features, that of a

25

bonding assembly and that of a drive assembly for feeding sheet material through the apparatus.

In more detail the bonding assembly comprises a welding foot
5 16 and an ultrasonic horn 18. In order to weld or to fuse together the two sheets of material 12, 14 the welding foot 16 is brought into contact with the static ultrasonic horn 18 and by applying high frequency vibratory (ultrasonic) energy into the fabric material containing thermoplastics, the two sheets
10 of the material are fused and bonded together.

The drive assembly comprises two moveable feed dogs 20 (only one shown in the side view) mounted within the ultrasonic horn 18. The feed dog is provided with a driving arrangement (not
15 shown) which causes the feed dog to move within the ultrasonic horn as will be described further below. The feed dog co-operates with the moving foot 22 to grip between the moving foot 22 and the feed dog 20 the sheet material 12, 14, and to drive the sheet material through the seaming apparatus 10.

20

The operation of the drive assembly and the welding/bonding assembly will now be described in more detail.

As show in Figure 1a the two sheets of material 12, 14 to be
25 bonded together are brought into contact with each other at the left hand side of the ultrasonic horn 18. Figure 1a shows

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the first step of the feed cycle of the drive assembly and it will be noted that the moving foot 22 co-operates with the feed dog 20 so as to grip between the serrated surface 24 of the feed dog 20 and the underside 26 of the moving foot 22 the two sheets of material. In this position the welding foot 16 is spaced apart from the ultrasonic horn 18 in a retracted position (see also the schematic front view shown on Figure 2).

10 The feed dog 20 is driven laterally by a drive mechanism (not shown) from the left side of the ultrasonic horn 18 (as shown in Figure 1a) to the right hand side of the ultrasonic horn 18 as shown in Figure 1b. Figure 1b shows the end of the feed cycle of the drive assembly which has fed the sheet material
15 across the surface 28 of the ultrasonic horn 18.

Turning now to Figure 1c, the moving foot 22 has been retracted and is now spaced apart from the sheet material 12, 14 on the surface 28 of the ultrasonic horn 18.

20 Simultaneously the feed dog 20 has moved downwardly within the ultrasonic horn and returned to the left hand side of the ultrasonic horn 18 as shown in Figure 1c. At the same time as the moving foot 22 is being retracted the welding foot 16 has come into contact with the sheet material on the surface 28 of
25 the ultrasonic horn 18 so as to nip the material 12, 14 and by virtue of the ultrasonic energy being transferred into the

sheet material causing the sheet material to be bonded and fused together. (This is shown also on the front view shown in Figure 3 wherein the welding foot and ultrasonic horn are in contact with each other and the feed dogs are spaced apart
5 from the two moving feet). From the position shown in Figure 1d the welding foot 16 is retracted and spaced apart from the ultrasonic horn 18 and returns to the position shown in Figure 1a. Simultaneously the feed dog 20 returns to the surface 28 of the ultrasonic horn and re-engages the underside of the
10 next portion of the two sheet materials to be bonded and fused together, as in Figure 1a.

In essence therefore the sequence of steps comprises a feed cycle feeding the sheet material onto the ultrasonic horn
15 followed by a bonding operation, followed by a feed operation, followed by a bonding operation and so on. Accordingly there is provided a sequence of individual or discrete weld or fusion points where the two materials have been bonded together. This sequence of discrete welds or fusion points
20 may be discontinuous or continuous (overlapping).

In practice it is desirable that there is provided two feed dogs in a side by side relationship together with two moving feet, again in a side by side relationship as shown in figures
25 2 and 3. For the avoidance of doubt the moving foot and feed

dog arrangement shown with reference to Figures 1a to d show only a single moving foot and single feed dog.

Various modifications may be made to the above described
5 embodiment without parting from the scope of the present invention. Thus there may be provided different configurations of seaming apparatus utilising either ultrasonic radiation or laser radiation, where the laser or ultrasonic device is provided above or below, to the left or
10 right of the horn and various examples of alternative embodiments are shown with reference to Figs. 4 to 18 as indicated on each figure utilising like reference numbers used above to describe like features. Reference number 29 is used to indicate a pin assembly which engages material to allow it
15 to be rotated. Reference number 30 is used to indicate a laser device.

Fig 1a

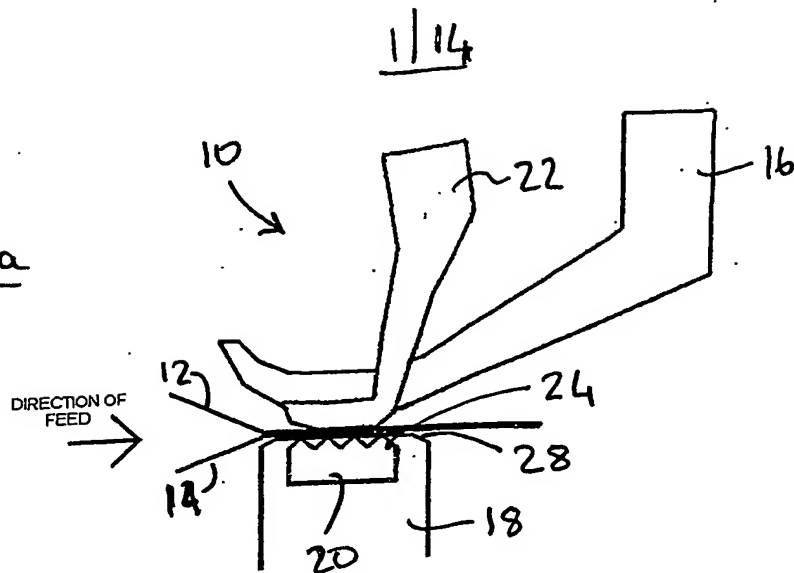


Fig 1b

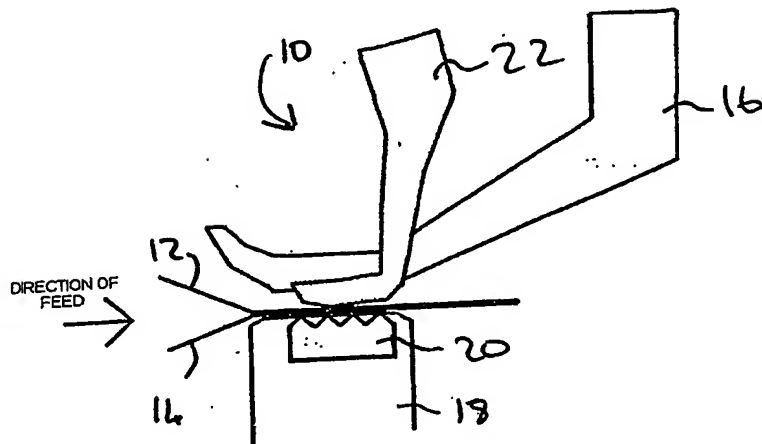


Fig 1c

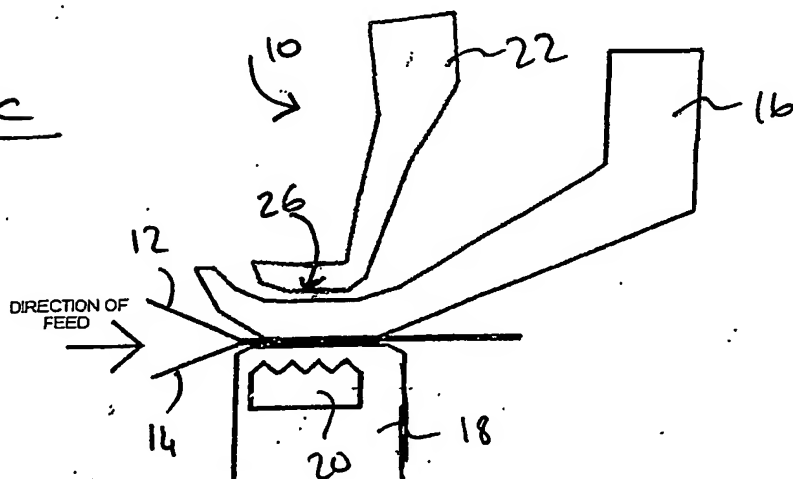


Fig 1d

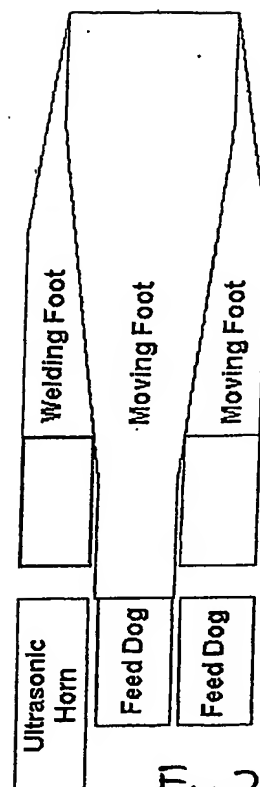
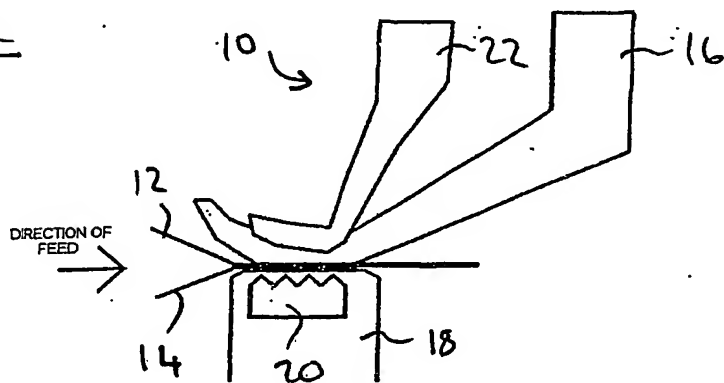


Fig 2

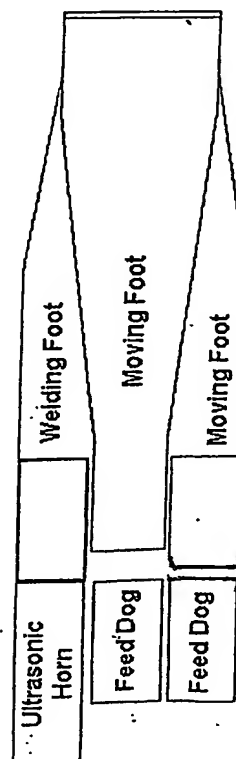
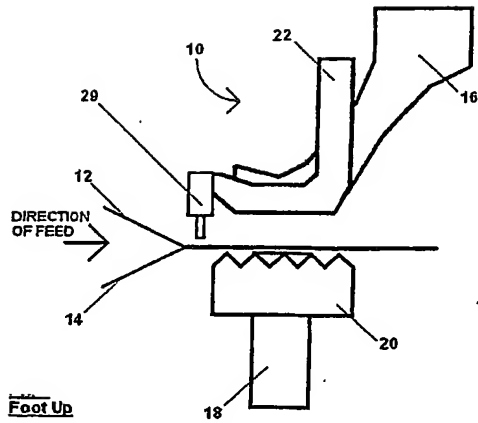


Fig 3

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ULTRASONIC
Foot Up

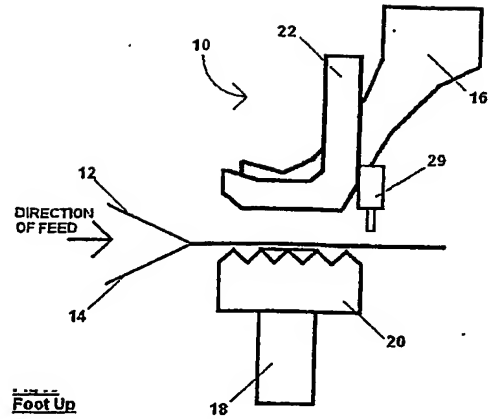
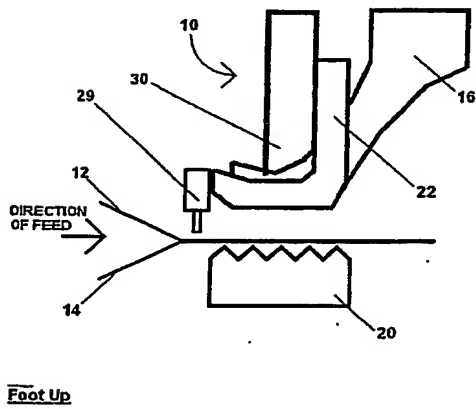


Fig 4



LASER TOP
Foot Up

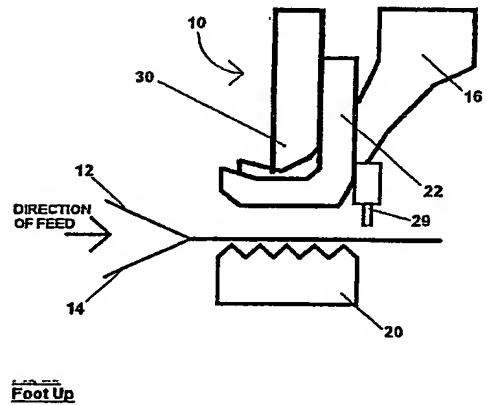
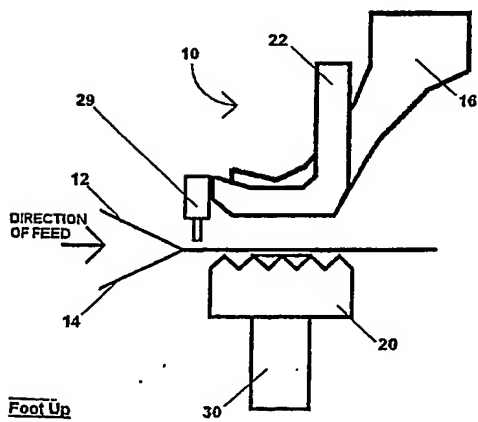


Fig 5



LASER UNDER
Foot Up

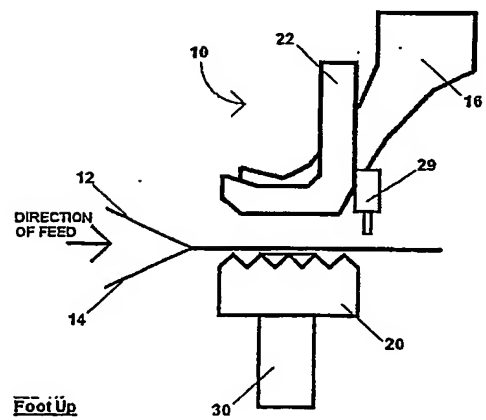
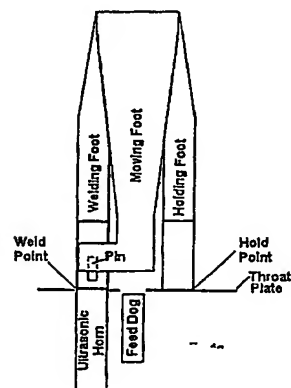
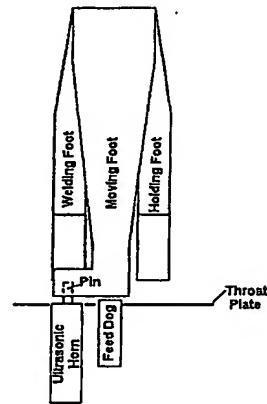
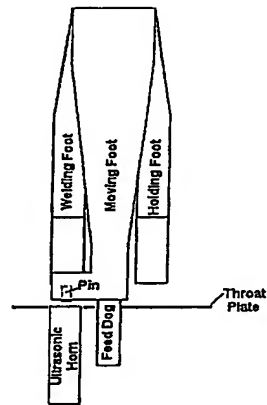
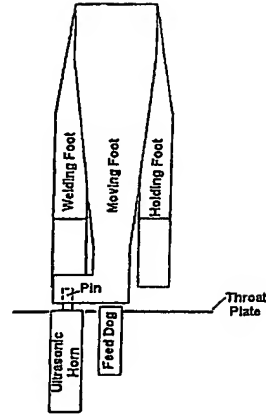
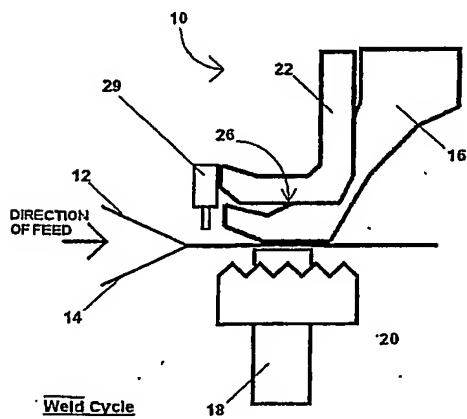
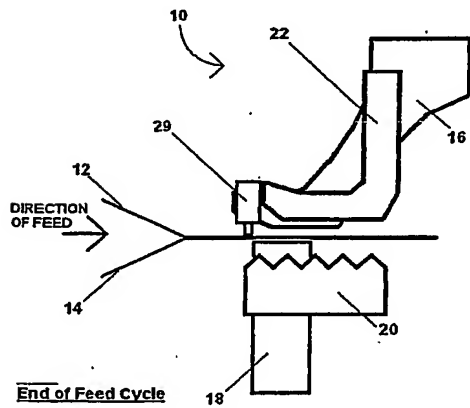
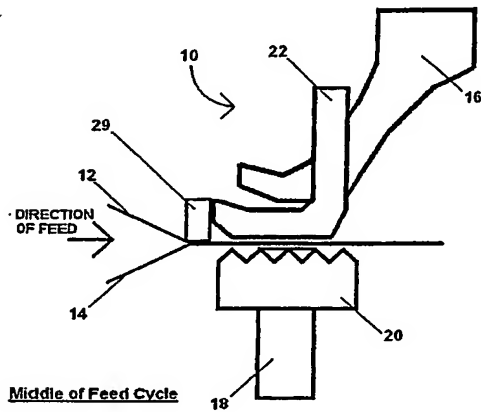
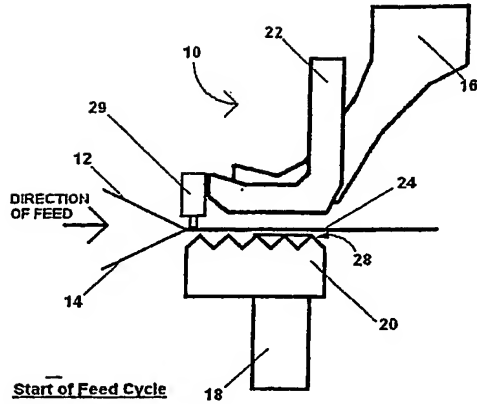


Fig. 6

3114

Ultrasonic Left ~ Pin Front

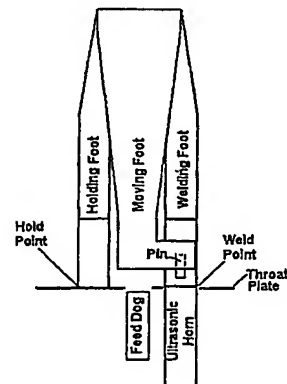
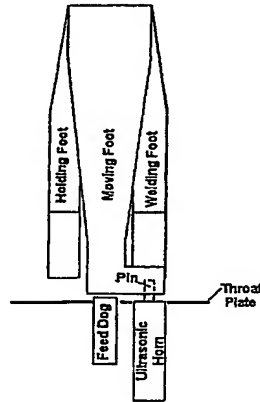
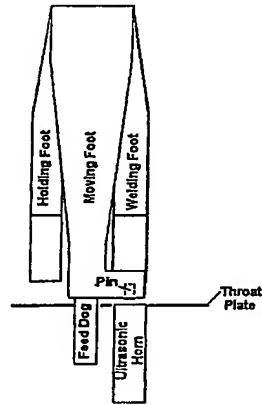
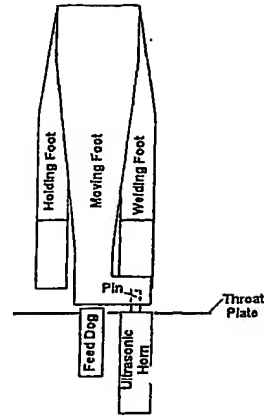
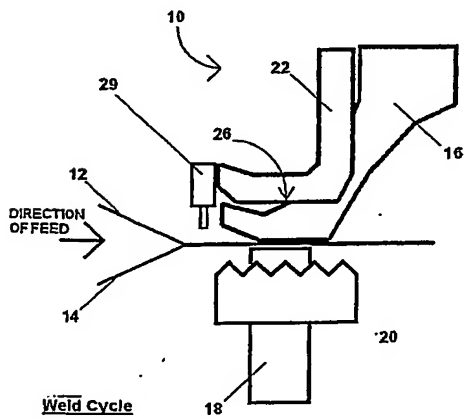
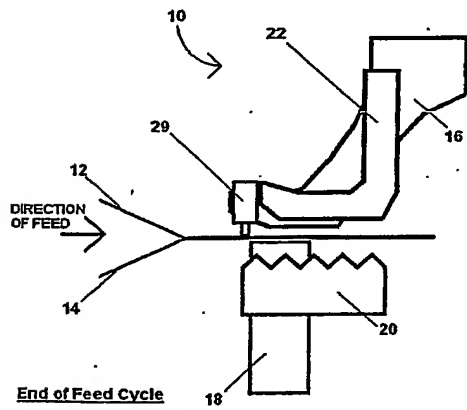
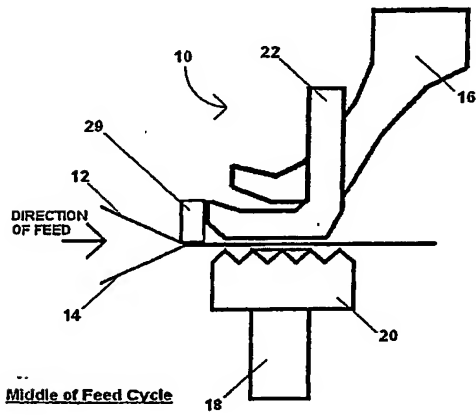
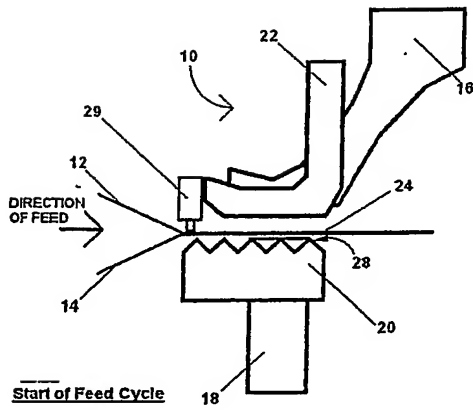
Fig. 7a-h



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Ultrasonic Right ~ Pin Front

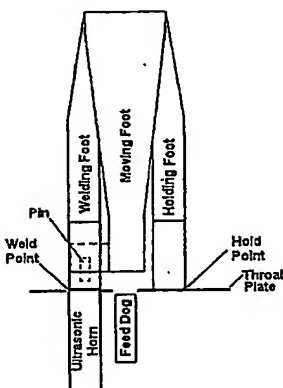
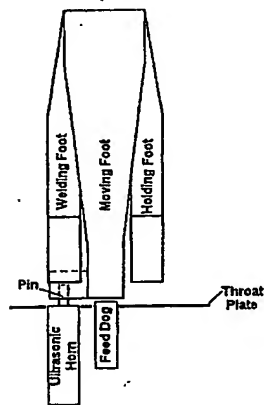
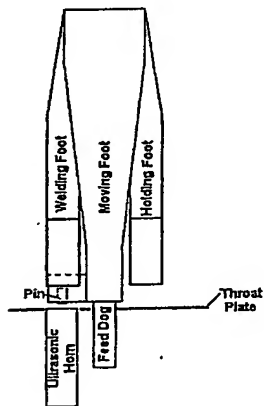
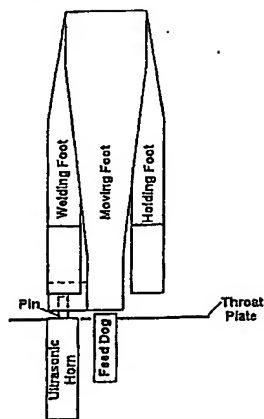
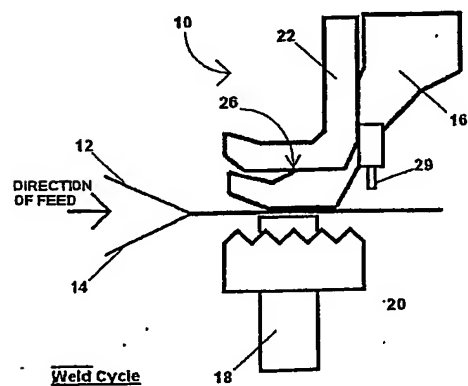
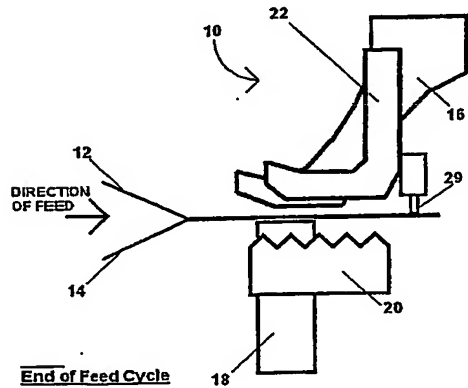
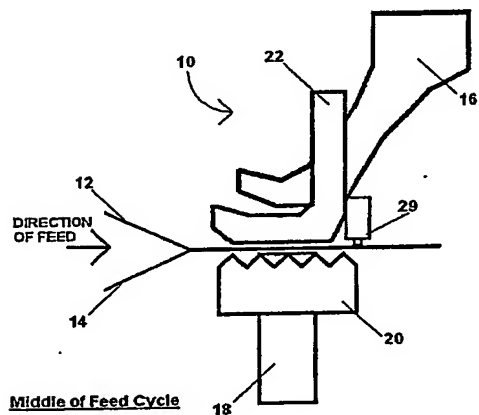
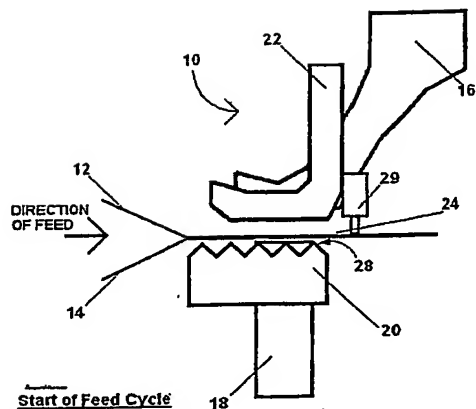
Fig 8a-h



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Ultrasonic Left ~ Pin Rear

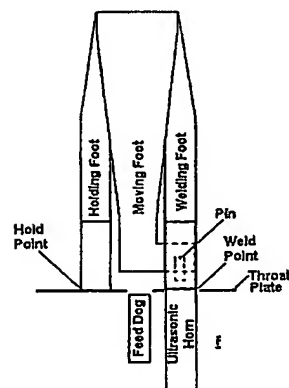
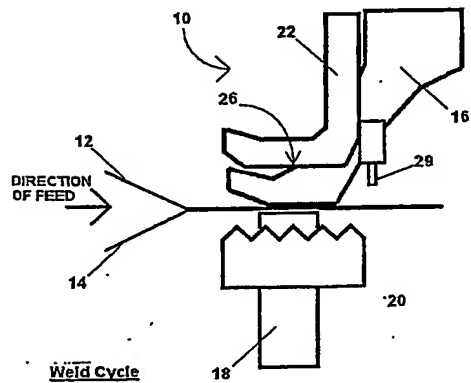
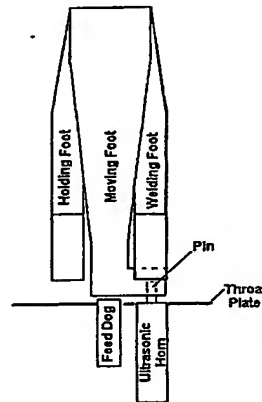
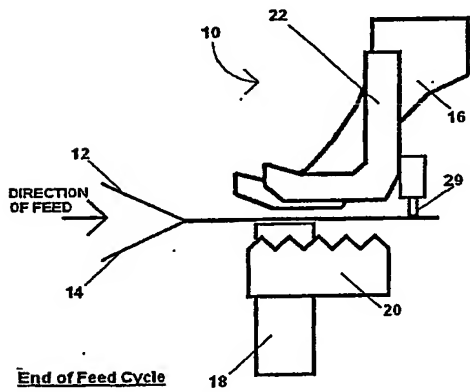
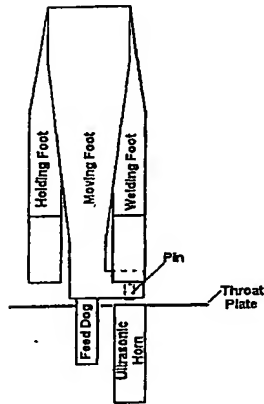
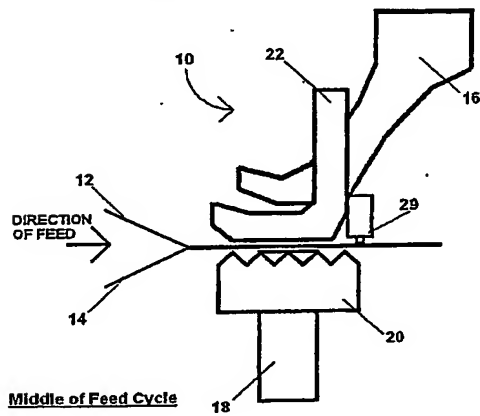
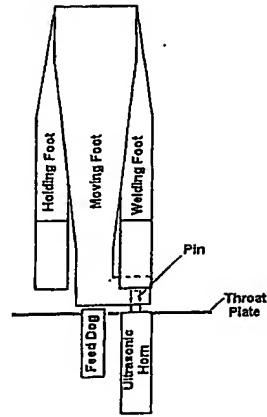
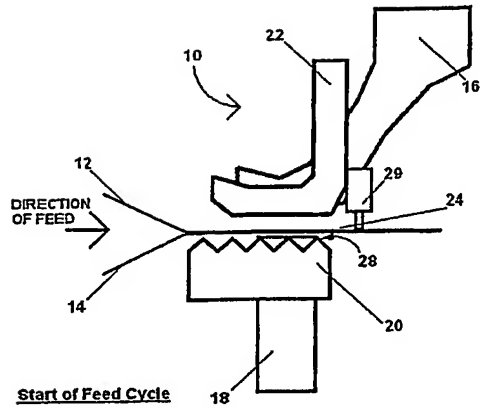
Fig 9a-h



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Ultrasonic Right ~ Pin Rear

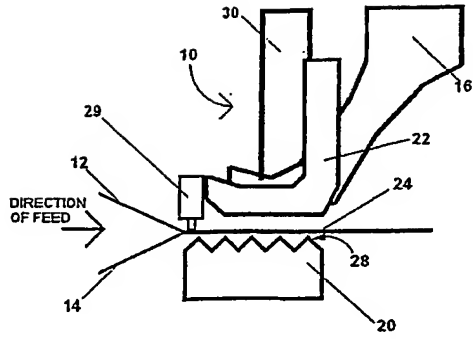
Fig 10a-h



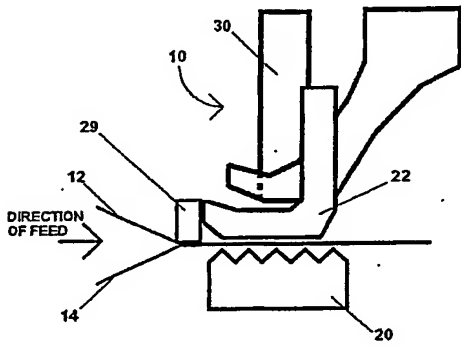
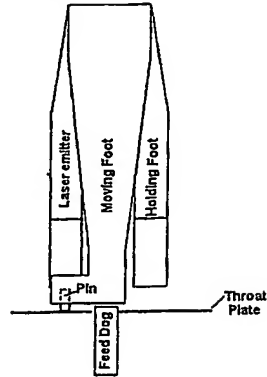
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Laser Top Left ~ Pin Front

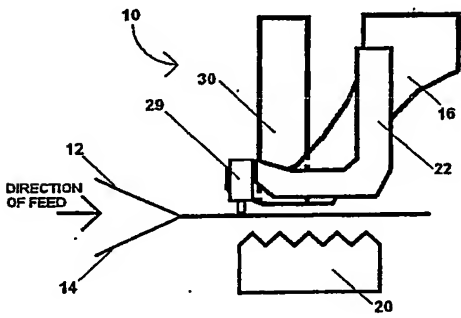
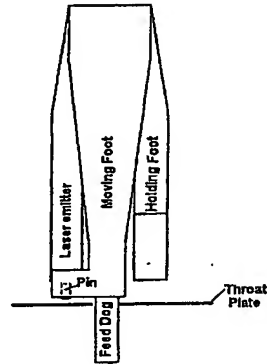
Fig 11a-h



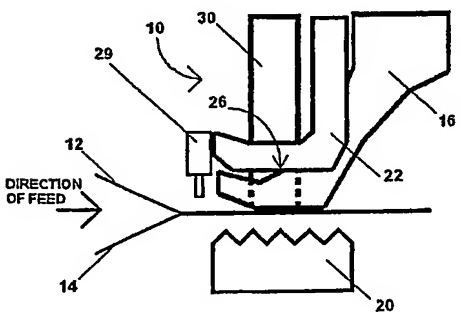
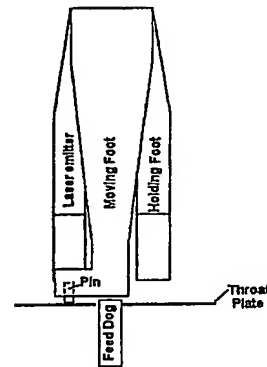
Start of Feed Cycle



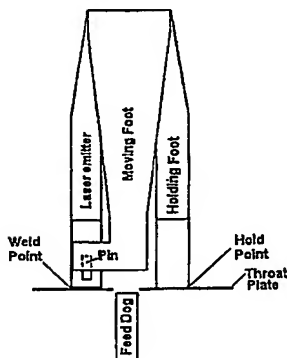
Middle of Feed Cycle



End of Feed Cycle



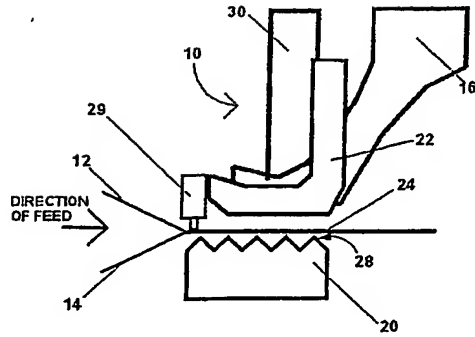
Weld Cycle



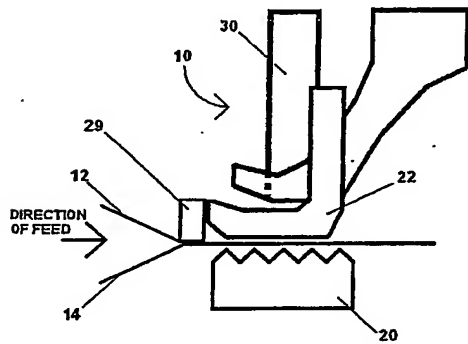
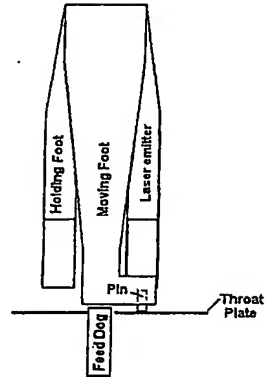
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Laser Top Right ~ Pin Front

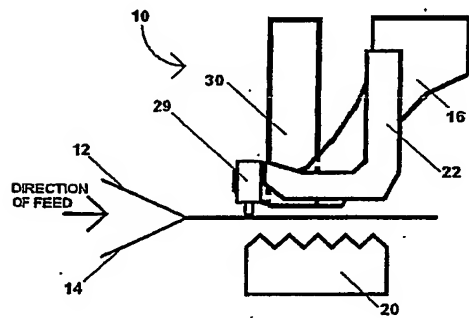
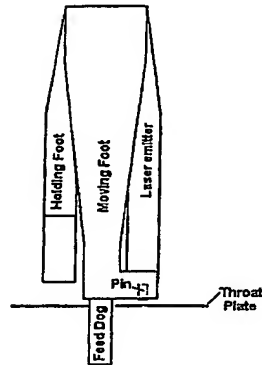
Fig 12a-h



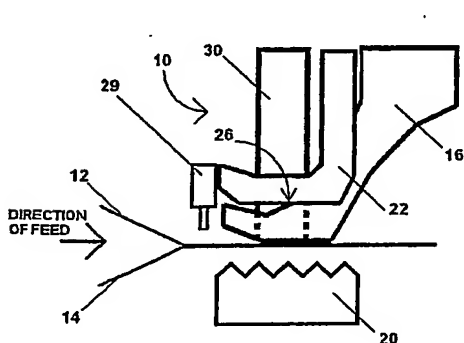
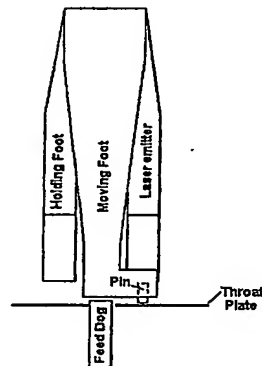
Start of Feed Cycle



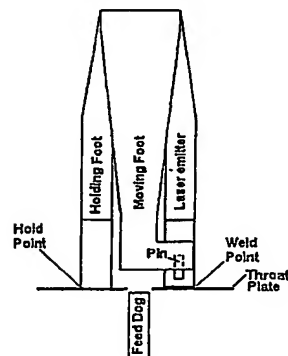
Middle of Feed Cycle



End of Feed Cycle



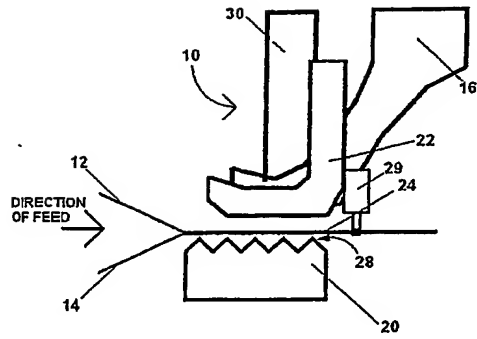
Weld Cycle



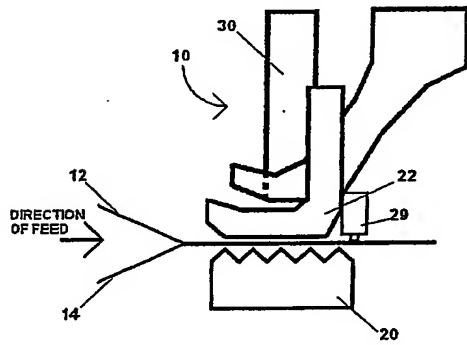
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Laser Top Left ~ Pin Back

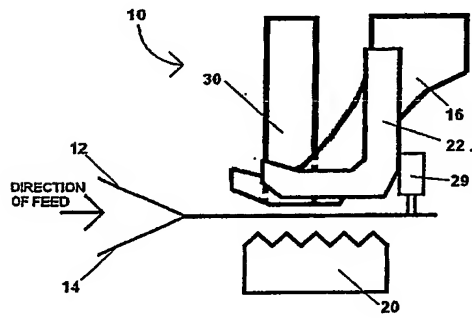
Fig 13a-h



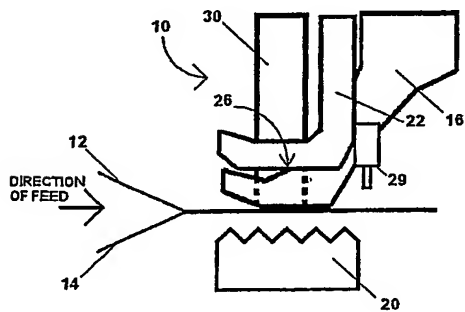
Start of Feed Cycle



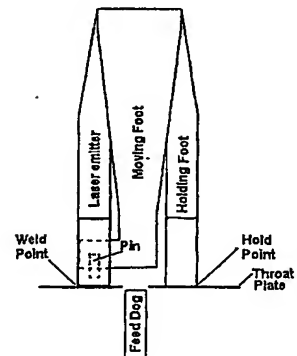
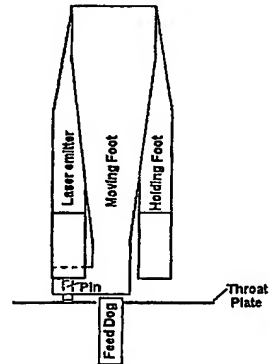
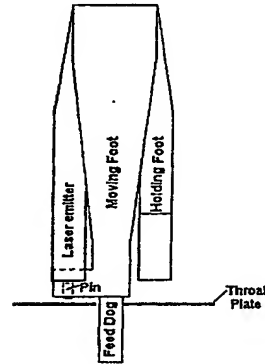
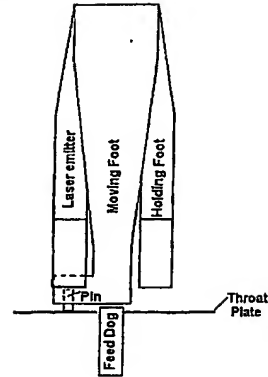
Middle of Feed Cycle



End of Feed Cycle



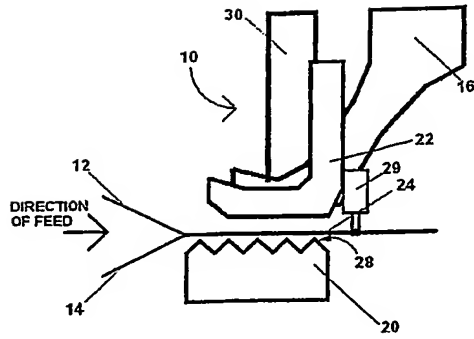
Weld Cycle



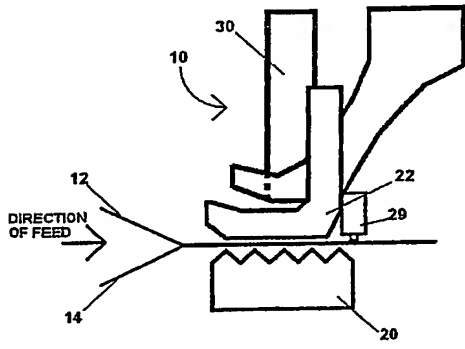
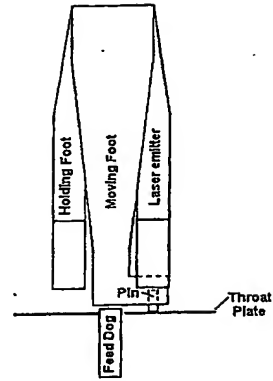
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Laser Top Right ~ Pin Back

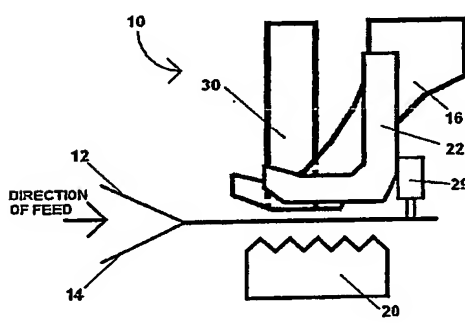
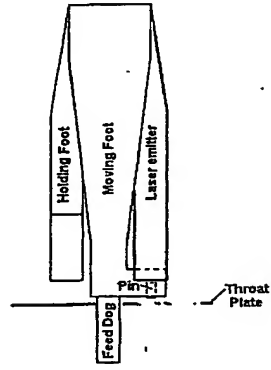
Fig 14a-h



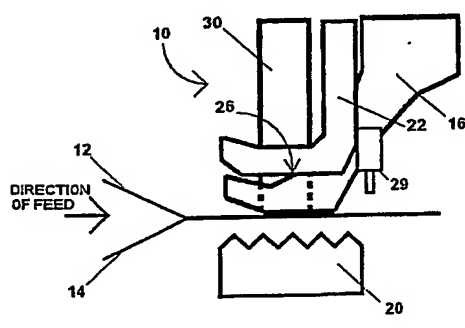
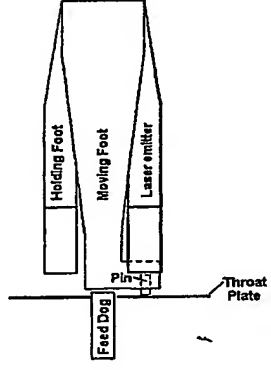
Start of Feed Cycle



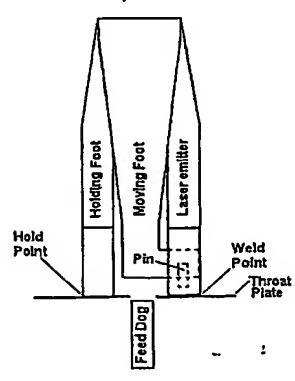
Middle of Feed Cycle



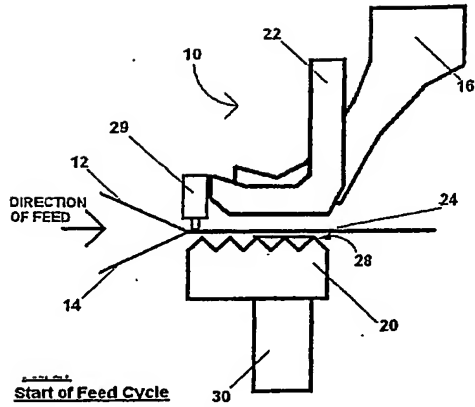
End of Feed Cycle



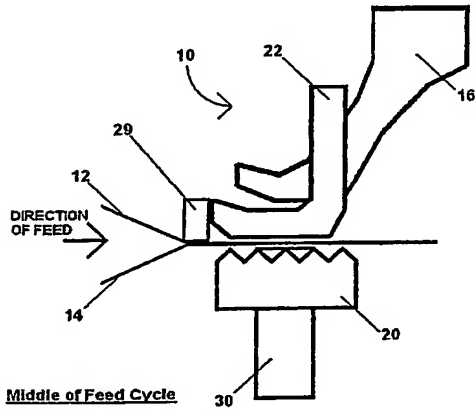
Weld Cycle



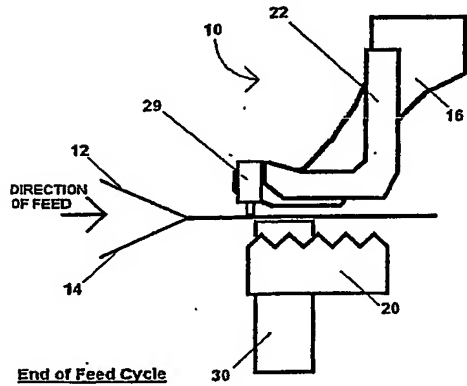
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Laser Under Left ~ Pin Front



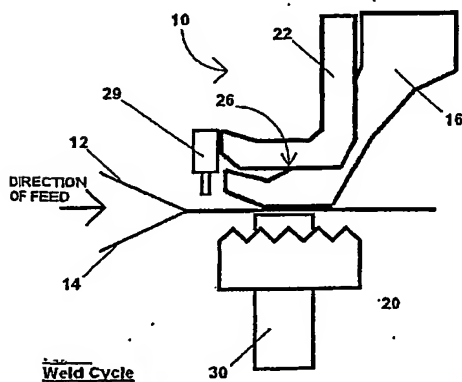
Start of Feed Cycle



Middle of Feed Cycle



End of Feed Cycle



Weld Cycle

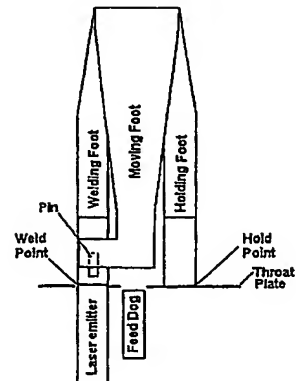
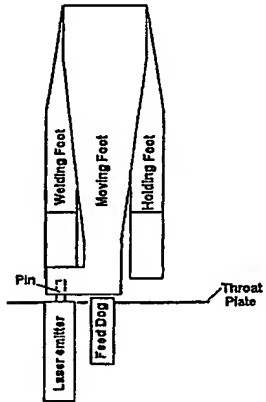
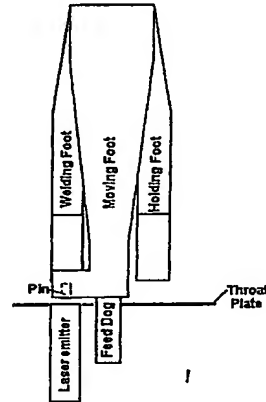
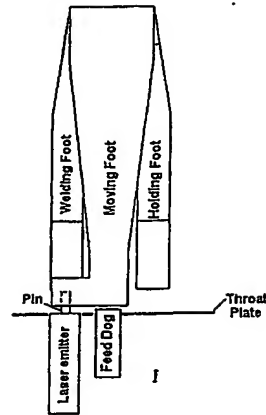
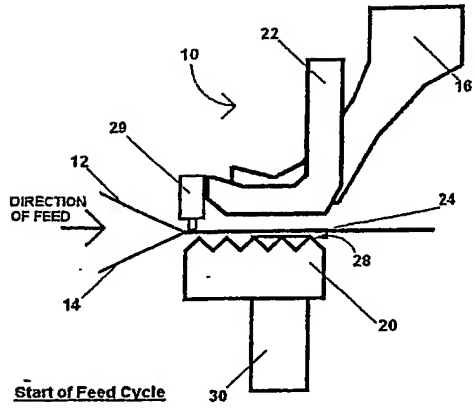


Fig 1Sa - h

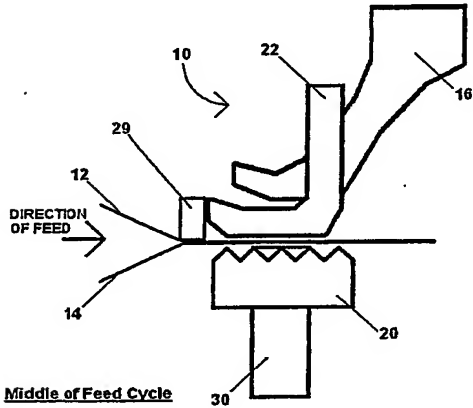
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Laser Under Right ~ Pin Front

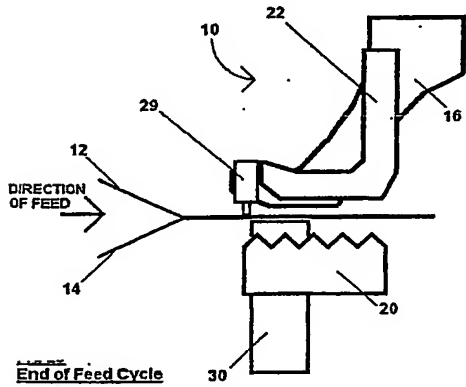
Fig 16a-h



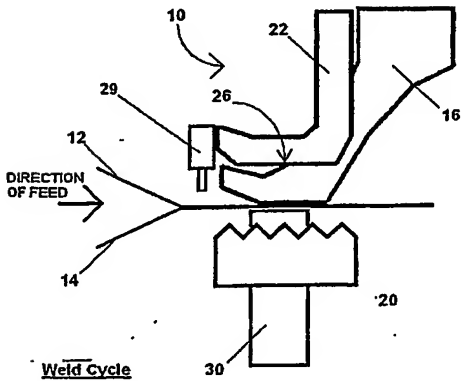
Start of Feed Cycle



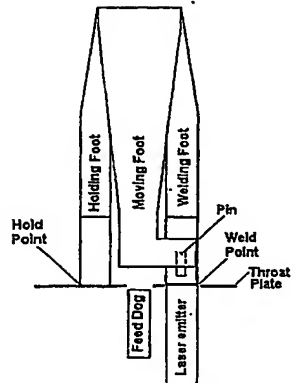
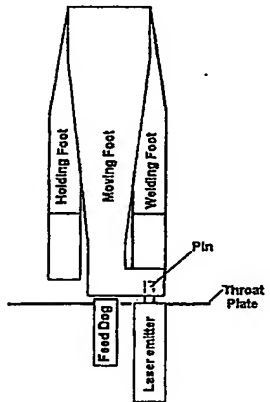
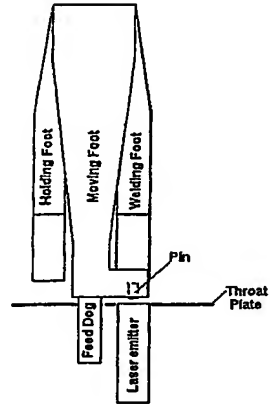
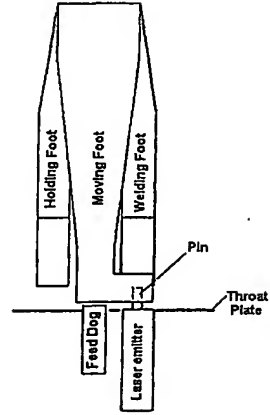
Middle of Feed Cycle



End of Feed Cycle



Weld Cycle



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Laser Under Left ~ Pin Back

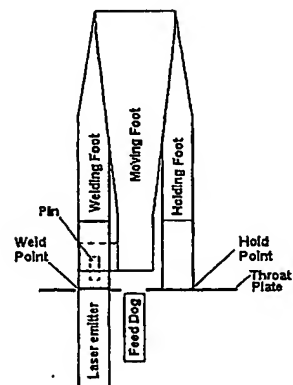
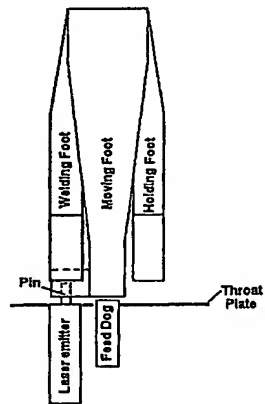
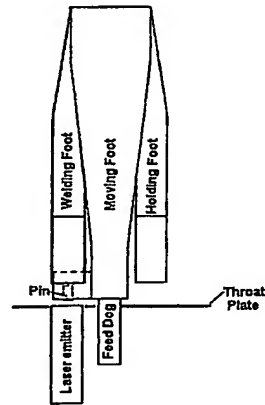
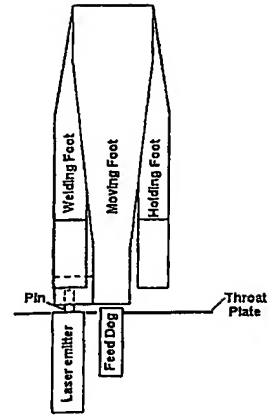
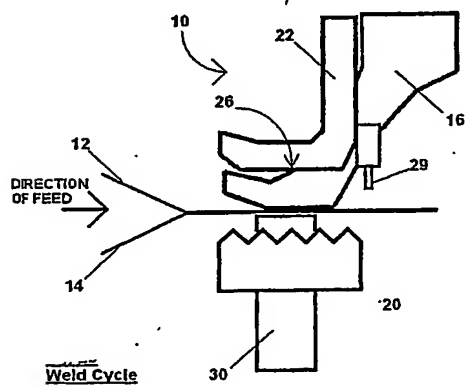
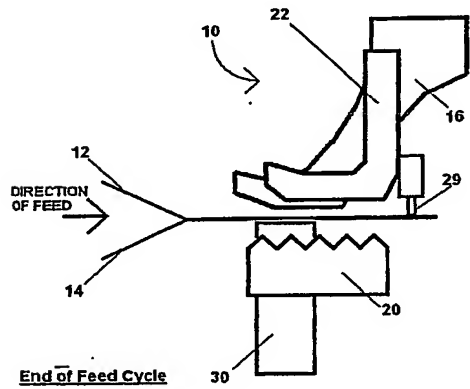
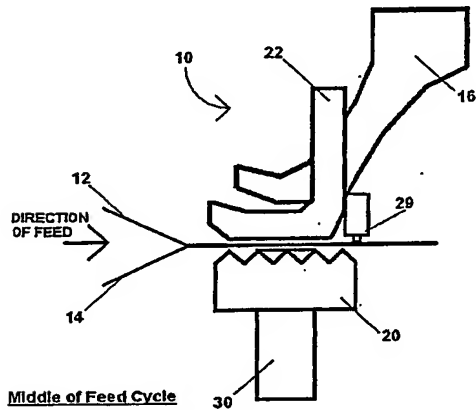
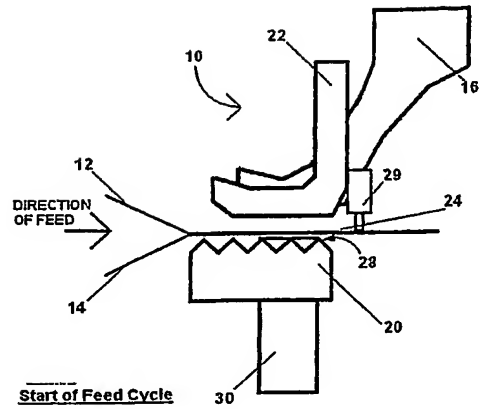
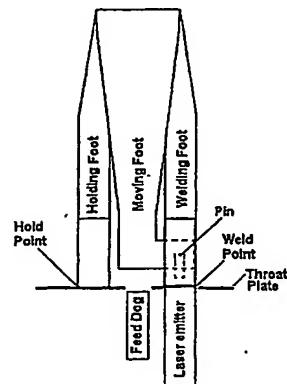
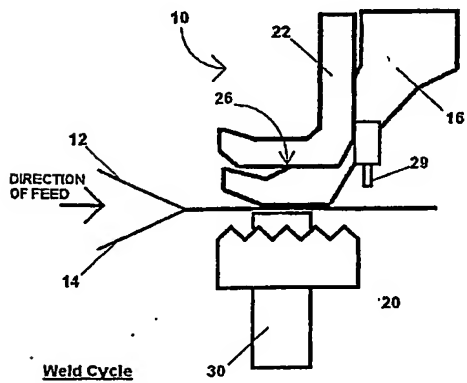
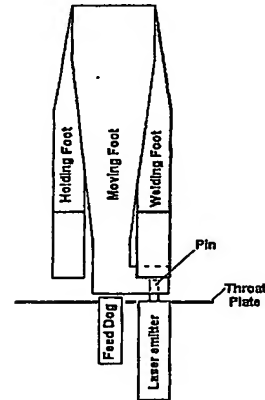
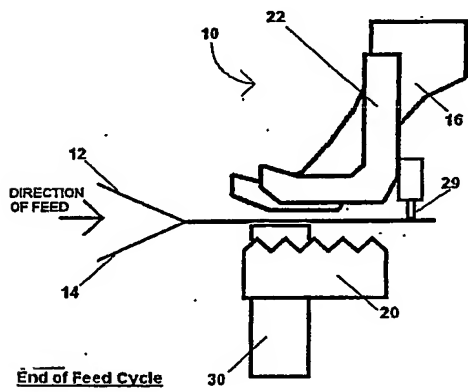
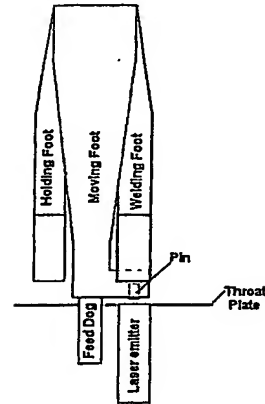
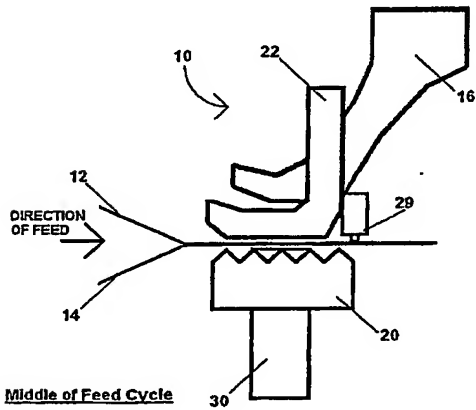
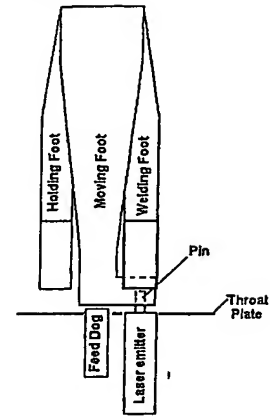
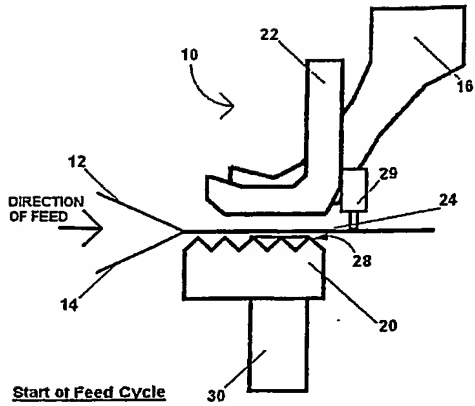


Fig 17a-h

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Laser Under Right ~ Pin Back

Figs 18a - h



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